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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2017/2018

**PPS0016 – INTRODUCTION TO PROBABILITY AND
STATISTICS**
(All groups)

17 MARCH 2018
2:30 PM – 4:30 PM
(2 Hours)

INSTRUCTION TO STUDENT

1. This examination paper consists of **5 pages** (including the cover page) with **5 questions only**.
2. Each question is worth **20 marks**. Attempt **ALL** questions.
3. A normal distribution table is provided in the appendix.
4. Please write all your answers in the Answer Booklet provided. Show **all relevant steps** to obtain maximum marks.

Question 1

An entomologist randomly selected a sample of *Scolopendra gigantea* that were bred in his laboratory, and measured their lengths in centimeters. The sample data collected are shown below.

62	72	66	79	83	61	85	72	64	74
71	42	38	91	66	77	90	74	63	64
68	42	62	47	62	83	71	56	39	78

- (a) Show **using formal methods of calculation** that the appropriate number of classes for the above data is 6 and that the appropriate class width is 9.

[4 marks]

- (b) Prepare a **frequency distribution table** for the data above using the template below. Use the lowest value of the data above as the lower limit of the first class.

Class limits	Class boundaries	Midpoint, m	Tally	Frequency, f	mf	m^2f	Cumulative frequency

[8 marks]

- (c) Estimate the **mean, mode, median** and **standard deviation** of the data based on the frequency distribution table. Round off final values to two decimal places.

[8 marks]

Question 2

- (a) The following table summarizes the membership for 3 student societies in a college:

Societies Joined	Number of Students
Engineering only	120
International Student only	95
Engineering and Japanese Cultural	52
International and Japanese Cultural only	23

The memberships for the Engineering and International Student Societies are 205 and 167, respectively.

- (i) Draw a Venn diagram representing the above information. [3 marks]

- (ii) Determine the number of students who joined **all three** societies.

[2 marks]

- (b) Consider the digits 0, 1, 2, 3, 4, 5. How many numbers between 300 and 500 can be formed (without repetition) if
- (i) there are no other restrictions? [3 marks]
 - (ii) they must be multiples of 5? [4 marks]
- (c) From a recent study, it is known that the probability of bankers choosing one risky investment from options A, B and C are 0.2, 0.5, and 0.3, respectively. It is also known that the chances of making a loss in those investments are 35%, 25% and 40%, respectively. Assume that each banker either lost or profited.
- (i) Draw the probability tree representing this information. [3 marks]
 - (ii) A random banker is selected and is found to have made a profit. What is the probability that it resulted from investment B? [5 marks]

Question 3

- (a) A shipment of 7 units of industrial washing machines contains 2 defective units. A laundromat makes a random purchase of 3 units. If X is the random variable that denotes the number of defective units in the purchase, **prepare a table** that shows the probability distribution of X . Then, calculate the **expected value of X** and the **variance of X** . [10 marks]
- (b) Suppose a continuous random variable X has a probability density function given as

$$f(x) = \begin{cases} x+1 & -1 < x < 0 \\ 1-x & 0 \leq x < 1 \\ 0 & \text{elsewhere} \end{cases}$$

- (i) Construct the **cumulative distribution function $F(x)$** as a piecewise-defined function. [7 marks]
- (ii) Find $P(-0.75 < X < 0.5)$. [3 marks]

Question 4

- (a) Muslih is having a golf practice at a driving range. Based on his previous records, 75% of his practice drives goes beyond a distance of 200m.
- (i) Find the probability that out of his next four practice drives, **at least three** of them goes beyond a distance of 200m. [5 marks]
 - (ii) What is the mean number of drives that goes to a distance of 200m or less if he makes 20 practice drives? [2 marks]

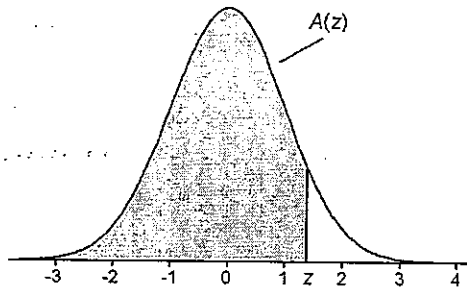
- (b) A plastics manufacturing company has determined that based on its many years of inspecting its products for quality control, there is an average of 1 imperfection per 1000cm^2 of plastic sheet it produces. As part of the daily inspection, the inspector randomly selects a 1m by 2m plastic sheet to check for imperfections.
- (i) Find the probability that the inspector will find 15 imperfections in the 1m by 2m plastic sheet. [5 marks]
 - (ii) Find the probability that the inspector will find 19 to 21 imperfections in the 1m by 2m plastic sheet. [4 marks]
- (c) A certain factory produces millions of capacitors per month. Its 1F capacitors have capacitance values that follow a normal distribution with a mean capacitance of 1.01F and a standard deviation of 0.16F. Calculate the probability that a random 1F capacitor selected from this factory has a capacitance of more than 1.2F. [4 marks]

Question 5

- (a) The average fuel consumption of Alva cars is 10 km/liter, with a standard deviation of 0.7 km/liter. Assuming that the fuel consumption of the cars follows a normal distribution, find
- (i) the probability that the mean fuel consumption of a random sample of 50 such cars falls between 9.7 and 10.2 km/liter, [6 marks]
 - (ii) the value of a such that $P(\bar{X} > a) = 0.85$, where $\bar{X}$ is the average fuel consumption of the sample. [6 marks]
- (b) The true proportion of geniuses at Cranium Institute is 25%. If a random sample of 60 students is selected, what is the probability that at least 80% of them are **not** geniuses? [8 marks]

TABLE A.1

Cumulative Standardized Normal Distribution



$A(z)$ is the integral of the standardized normal distribution from $-\infty$ to z (in other words, the area under the curve to the left of z). It gives the probability of a normal random variable not being more than z standard deviations above its mean. Values of z of particular importance:

z	$A(z)$	
1.645	0.9500	Lower limit of right 5% tail
1.960	0.9750	Lower limit of right 2.5% tail
2.326	0.9900	Lower limit of right 1% tail
2.576	0.9950	Lower limit of right 0.5% tail
3.090	0.9990	Lower limit of right 0.1% tail
3.291	0.9995	Lower limit of right 0.05% tail

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998
3.6	0.9998	0.9998	0.9999							

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